



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10


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WATER
DIVISION

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MEMORANDUM

SUBJECT: Support of EPA's CWA Action on the Idaho Site-Specific Criteria for Temperature for the Snake River Below the Hells Canyon Dam to the Confluence with the Salmon River

FROM: Rochelle Labiosa, Water Quality Standards Coordinator 

THRU: Hanh Shaw, Standards and Assessment Section Manager

TO: Dan Opalski, Water Division Director

The purpose of this memo is to provide the additional technical rationale for the EPA's decision pursuant to its authority under section 303(c)(3) of the Clean Water Act, 33 U.S.C. § 1313(c)(3), and 40 CFR Part 131.

The EPA has examined the scientific basis of Idaho's June 8, 2012, submittal and identified the potential effects of the proposed action in the Biological Evaluation (2019), including the application of a lagged running 7-day average of the daily maxima (WMT), such that the first day the spawning criteria are met is on October 29 (calculation period starting on October 23). The EPA has also evaluated the revision to the magnitude of the criteria during the October 23-November 6 time period from a 13.3°C criterion (as a MWMT or maximum of the 7-day average of the daily maxima calculation) to a criterion of 14.8°C (as a rolling 7-day average of the daily maxima), both of which include an assumed allowance of 0.3°C above the applicable criteria.¹ The following section describes this process and results.

- I. Scientific Basis: Evaluation of the lines of evidence used by Idaho to support its conclusion that the proposed site-specific criteria is protective

Endangered Species Act Biological Evaluation of the EPA's proposed approval

In 2019, the EPA developed a Biological Evaluation (BE) to analyze the effects of its proposed approval of the Idaho revised site-specific criteria (SSC) for temperature. The EPA provided the BE to the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) on April 4, 2019, pursuant to Section 7(a)(2) of the Endangered Species Act (ESA). The EPA requested that NMFS initiate formal consultation and that USFWS concur on the EPA's not likely to adversely affect determination. In response to the EPA's request, on May 3, 2019, NMFS agreed to initiate formal ESA consultation and USFWS concurred with the EPA's determinations that the Agency's proposed approval action was not likely to adversely affect bull trout and its designated critical habitat.

¹ A 0.3°C de minimis allowance above the applicable criteria

History of ESA Consultation

- December 7, 2018: EPA submitted a request for confirmation of the list of species to NMFS and USFWS.
- December 19, 2018 and December 20, 2018: EPA received letters of concurrence on the Agency's identified list of potentially affected listed species relevant to the proposed action, from USFWS and NMFS, respectively.
- December 19, 2018: In response to the December 7, 2018 request from the Idaho Department of Environmental Quality (DEQ), consistent with 50 CFR 402.02, EPA recognized DEQ as an applicant for the purposes of the consultation.
- October to March 2019: EPA conducted phone calls during pre-consultation period with NMFS and USFWS.
- March 12, 2019: EPA shared an interim draft BE with the Services (NMFS and USFWS).
- March 2019: EPA exchanged emails with the Services to provide clarification on the draft BE and to discuss revisions.
- April 4, 2019: EPA submitted a final BE to the Services.
- April 24, 2019: EPA received a request from NMFS to clarify the effects determinations for the Southern Resident killer whale designated critical habitat; EPA responded on April 25, 2019.
- May 3, 2019: EPA received concurrence from USFWS that the Agency's proposed action is not likely to adversely affect bull trout in the Action Area. EPA received a determination from NMFS that the BE is sufficient to initiate formal consultation.
- August 29, 2019: EPA received excerpts of the conservation measures from the draft Biological Opinion from NMFS.
- August 29, 2019 to September 11, 2019: EPA, DEQ, and NMFS discussed the draft conservation measures and exchanged comments and recommended revisions.
- September 25, 2019: NMFS transmitted the final biological opinion to EPA.

When EPA developed the BE, EPA supplemented the data DEQ relied upon in its submission with data obtained from updated literature searches. In this case, the EPA's analysis included: 1) the studies and analyses submitted by the state of Idaho, 2) the EPA's Temperature Guidance, companion documents, and literature cited therein, and 3) a review of the literature since the 2003 publication date of the Temperature Guidance. Conducting an updated literature search is a standard method for identifying additional studies and data may have become available between the time that a new or revised water quality standard (WQS) was adopted and the time of the EPA's action on a proposed revision to that standard.

The NMFS 2019 Biological Opinion evaluating the effects of the EPA's proposed action to approve Idaho's SSC on threatened and endangered species, pursuant to Section 7(a)(2) of the Endangered Species Act

Along with the review of the criteria within the EPA's BE, the EPA also considered the analysis in NMFS's Biological Opinion (2019).² In its Opinion, NMFS analyzed the potential effects of the action

² NOAA 2019: WCRO-2019-00175 September 25, 2019. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation.

on threatened and endangered species and their designated critical habitats under its purview. The USFWS (2019)³ concurred on the EPA's determination that the action may affect, but is not likely to adversely affect, bull trout and its critical habitat, the only distinct population segment (DPS) under USFWS' purview that was identified as being potentially affected by the EPA's action.

Three studies conducted in declining thermal regimes

The Idaho submission included citations to literature published in journal articles (Olson and Foster 1957; Geist et al. 2006) and a third study, the results of which were made public but not published as a journal article (such as Olson et al. 1970), as well as state-submitted analyses (e.g., a regression model comprising the three studies combined, source: Idaho Power Company). In his 2011 review,⁴ McCullough highlighted the effects identified for the October cohort in the Olson et al. 1970 as more representative of the potential adverse effects to fall Chinook spawning from the revised SSC than the other studies. In contrast, the test gametes used in Olson et al. 1957 were sourced from one pair of fish, and, therefore, the variance between different fish was not characterized in terms of the range of potential effects, and effects could be more or less than what was revealed by the test subjects. NMFS incorporated Geist et al. 2006, which was the only study used as evidence by Idaho that is newer than the 2003 Temperature Guidance, into its review of the literature for the 2019 Biological Opinion, albeit with some caveats about potential underestimation of effects due to the study design.^{5,6}

Composite regression model

The EPA reviewed the regression model submitted by Idaho and identified flaws with the model, including: 1) at least one error was made in transforming the temperature data from the Olson et al. 1970 paper; and 2) no meta-analysis was performed in order to combine the data into a single regression, despite differences in laboratory methodologies, goals, assumptions, and approaches for each of the studies. Therefore, the EPA did not rely on the results of the regression model in its approval of the SSC. Similarly, NMFS did not rely on the regression model for its 2019 Biological Opinion.⁷

The EPA identified limitations in the interpretation of the outcomes from the Geist et al. 2006 study. In this study, adult Chinook salmon were held in favorable conditions (12°C) prior to gamete harvest. This is a condition much cooler than the revised SSC-allowed temperatures and likely led to an underestimation in the level of effects for eggs and fry.

Sound scientific rationale that the EPA action is protective of designated use – independent analysis of all three studies

³ Letter from Gregory Hughes, Idaho State Supervisor, USFWS, to Hanh Shaw, EPA, concurring with the EPA's not likely to adversely affect determination for bull trout in the Action Area (01IFWO-2019-I-1077); May 3, 2019.

⁴ Submitted to EPA by the Nez Perce Tribe; June 24, 2011

⁵ NOAA 2019: WCRO-2019-00175 September 25, 2019. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation.

⁶ NMFS noted that the coldest cohort (13C) percent loss rate was higher than anticipated and noted that the adults were held in 12C temperature well water prior to the laboratory testing, which could lead to an underestimate of effects compared to fish exposed to higher temperatures prior to spawning, including migratory Chinook in the Snake River.

⁷ Snake River Hells Canyon Site Specific Temperature Criterion NMFS Consultation Number: NMFS 2019: WCRO-2019-00175 September 25, 2019

The EPA (2019) BE analysis focused on the effects to eggs and fry identified in the October cohort from the Olson et al. 1970 study, which the EPA identified as representing the closest conditions to those allowed by the revised SSC. In its Opinion, NMFS calculated the threshold effect levels from a combination of the Olson et al. 1970 and the Geist et al. 2006 studies (see Table 1).

Table 1. Taken from the NMFS Biological Opinion, Table 8.

Table 8. Estimated annual proportion of redds counted for specified maximum daily temperature intervals and the associated estimates of average percent mortality.

Year	Upper Reach: % of Total Redd Counts			Lower Reach: % of Total Redd Counts		
	≥17°C	16.5–16.9°C	14.5–16.4°C	17°C	16.5–16.9°C	14.5–16.4°C
2010	1.3	0.9	50.9	0	0	3.0
2011	0.6	0.6	33.9	0	0	1.1
2012	0.7	0.5	55.1	0	0	4.6
2013	0.6	1.2	44.4	0	0	0.6
2014	26.0	9.9	47.5	0.3	0.3	14
2015	42.4	15.0	35.2	3.9	3.9	29.1
2016	0	7.3	69.3	0	0	0
2017	0	0	26.8	0	0	0
Average % of Redds Counted	4.2	2.9	46.9	0.1	0	3.3
Estimated Average % Mortality ¹	4.1	0.7	3.0	0.05	0.01	0.21

¹Average percent mortality estimates were calculated by multiplying the reported percent mortalities associated with each thermal regime by the average percent of redds constructed for each thermal regime. The percent mortality associated with each thermal regime is as follows: ≥17°C (98 percent mortality estimate [Olson et al. 1970]); 16.5–16.9°C (23.6 percent mortality estimate [Olson et al. 1970]); and 14.5–16.4 (6.4 percent mortality estimate [Geist et al. 2006]).

Specifically, for the analysis of the 14.5–16.4°C range impacts, NMFS used the results of the Olson et al. 1970 study; however, NMFS used the lower end of the range, i.e. the effects level at 14.8°C. This resulted in the derivation of a lower level of effect at that temperature range than the Olson et al. 1970 October cohort 15.9°C effect level (Olson et al. 1970: 11.01% at 14.8°C, and 28.14% at 15.9°C). The EPA identified these differences since they add a wider range of uncertainty to the overall analysis. Similar to the EPA approach, NMFS made several conservative assumptions, such as assuming a linear loss of spawners from the loss of redds.

NMFS identified the percent losses of eggs and fry due to the temperatures allowed by the SSC derived from the studies referenced in the state's submission, including from Olson et al. 1970). The following estimated percent mortalities resulted for each respective thermal initiation regime: 4.5 (12.6°C); 3.6 (13.7°C); 11 (14.8°C); 28.1 (15.9°C); 59.6 (17°C); 97.4 (18.1°C); and 100 (19.2°C); and from Geist et al. (2006): 16.6 (13°C); 4.5 (15°C); 4.2 (16°C); 6.2 (16.5°C); and 98.3 (17 °C). NMFS characterized the effects estimation as follows:

“To err on the side of the species, we have relied upon the Olson et al. (1970) mortality results for eggs incubated at temperatures of 14.8°C. It is conservative because the authors noted that while statistically significant differences in mortality were observed between control and lower test temperatures, the 11 percent overall mortality (which was recorded for the embryos incubated at initial temperatures of 14.8°C) compares favorably with the average mortalities at USFWS fall Chinook rearing stations at Spring Creek and Little White Salmon on the Lower

Columbia. For incubation temperatures between 16.5–16.9°C and greater than 17°C, we relied mortality estimates reported by Olson et al. (1970) and Geist et al. (2006), respectively.”

Although the 98 percent mortality estimate at 17°C appears to be conservative (per Geist et al. 2006, as well as Olson et al. 1970), the application of the 6.4 percent mortality rate from Olson et al. 1970 for the temperatures between 14.5-16.4°C is not as conservative as applying the 28.59 percent rate that would be derived from the midpoint of that range from the Olson et al. 1970 study.

NMFS concluded that approval of the SSC will allow for increased water temperatures during the early spawning time period, as well as during adult migration and holding time, relative to the existing criterion of 13°C, which is within the optimal range. Such increased water temperatures are likely to adversely affect fall Chinook and its critical habitat. Specifically, elevated temperatures are likely to increase pre-spawn mortality, reduce gamete viability, and reduce egg-to-fry survival between late September/early October through the first week of November.

Field data (Hanford Reach of the Columbia River)

The state submitted data from the Hells Canyon Reach of the Snake River demonstrating that redds are emplaced in water temperatures greater than those allowed by a 13°C 7dadm criterion (Idaho’s previously effective SSC and the recommended salmon spawning criterion from the EPA’s Temperature Guidance), and also indicated that for the Hanford Reach Columbia River population of fall Chinook (considered to be a healthy population), spawning takes place at water temperatures in excess of the 13°C 7dadm. As explained by the EPA in the BE (2019), there is uncertainty with the conclusion that this supports a change in the SSC. First, the Connor et al. 2018 modeling for the Snake River showed that many redds emplaced in the early part of the spawning season may in fact be empty due to the costly energetics of migration, particularly in the early spawning period, in the Columbia and Snake Rivers. Second, although the fall-run Chinook population in the Hanford Reach is considered healthy, the Hanford Reach is not directly comparable to the Snake River in terms of its greater thermal diversity, water quality, and habitat quality (EPA 2019). Despite these differences, NMFS considered the Hanford Reach to be a comparable proxy for successful redd emplacement under the river temperatures allowed by the SSC (NMFS 2019).

Population trends

The state cited to recent evidence of an increase in the fall Chinook returns to the Snake River (as of 2012). However, in recent years, that trend has reversed, with reduced returns since 2015. Although it is possible that poor ocean conditions over the last several years are influencing that reduction in returns, the role of in-stream Snake River temperature or other water quality issues cannot be ruled out as a factor. Regardless of the cause, there is additional uncertainty in the system that must be considered.

NMFS concluded that the EPA’s action may affect, but is not likely to adversely affect, Snake River fall and spring/summer Chinook salmon (*Oncorhynchus mykiss*), Snake River Basin steelhead (*O. mykiss*), Snake River sockeye salmon (*O. nerka*), Southern Resident killer whale (*Orcinus orca*), and designated

critical habitats for all of these species.^{8,9} NMFS also concluded that the action is not likely to jeopardize the continued existence of Snake River fall Chinook salmon, and determined that the action will not destroy or adversely modify designated critical habitat for Snake River fall Chinook salmon. In support of the no-jeopardy conclusion, NMFS included an analysis of recruit-per-spawner based on a Beverton-Holt stock recruit relationship fitted to Snake River brood years data from 1991–2010 (Figure 14 of NMFS’s Biological Opinion). NOAA (2017)¹⁰ postulated that because the Beverton-Holt was the best-fit model (based on Akaike Information Criterion scores or AIC scores) out of the four models tested, that density-dependent recruitment indicates a lack of habitat is inhibiting the responsiveness of total stock recruitment, and that other limitations on the productivity of spawners in the Snake River (e.g., temperature effects) are secondary to such potential habitat limitations (carrying capacity) within the Snake River. The EPA noted that the conclusions are based on data several years out of date (brood years 1991-2010; representing up to year 2013 recruits). Further, annual adult spawner returns to the Snake River have decreased in recent years (NMFS 2019).

II. Consideration of Comments in the Record

The state considered many comment letters during its draft rule deliberations, proposal, and final rule adoption. The EPA submitted a comment letter to the state in 2011, where most significantly, the Agency identified limitations in one of the major studies cited as the basis of the state’s submission, i.e. the Geist et al. 2006 study. As previously explained, the EPA found that the study potentially underestimated the effects of temperature on eggs and fry, since adult fish prior to harvest of gametes were held at 12°C, and as such did not experience the totality of high temperature exposures typical of conditions that returning adults would be exposed to while swimming the length of the Columbia and Snake Rivers to the Hells Canyon Dam in the summer-fall period. The EPA comments also asserted that new and unambiguous information would be needed to support the SSC revision. Other comment letters, including a letter from NMFS, were supportive of the SSC as protective of the designated use. Additional commenters identified the need for clarifying the rule language. The state produced a detailed comment-response document that accompanied the final rule.¹¹

Further, a review by McCullough and others (CRITFC 2011, also resubmitted by the Nez Perce Tribe to EPA in 2019) took issue with the Geist et al. 2006 study (with comments similar to EPA’s 2011 comments) as well as the Olson and Foster 1957 study. The commenters identified as a source of concern the narrowing of the diversity of fall Chinook that would be present by increasing the

⁸ NMFS 2019: WCRO-2019-00175 September 25, 2019. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response Snake River Hells Canyon Site Specific Temperature Criterion NMFS Consultation Number: 2019-0017 5.

⁹ For all other species and critical habitat under NMFS purview identified to be potentially affected by EPA’s action, NMFS found that they “may be affected but are not likely to be adversely affected” by the Agency’s proposed action; likewise, USFWS concurred on the U.S. EPA’s determination that the Agency’s proposed action was not likely to adversely affect the bull trout DPS and its critical habitat. The EPA determined that its proposed action would have “no effect” on all other threatened and endangered species that were not identified to be potentially affected by the Agency’s action.

¹⁰ 2017 ESA Recovery Plan for Snake River Fall Chinook Salmon (*Oncorhynchus tshawytscha*). NOAA NMFS West Coast Region. November 2017. Available at:

https://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/interior_columbia/snake/Final%20Snake%20Recovery%20Plan%20Docs/final_snake_river_fall_chinook_salmon_recovery_plan.pdf

¹¹ Available at <http://www.deq.idaho.gov/media/750127-58-0102-1102-public-comment-summary.pdf>

magnitude of the SSC from 13°C to 14.5°C, together with Idaho's coldwater criteria application during part of the spawning period, potentially resulting in impacts to gametes, pre-spawning mortality, and loss of eggs and fry. In addition, CRITFC (2011) commented that narrowing of the acclimation range could occur, endowing the species with less flexibility for dealing with rapid change from, for example, development and climate change, among other factors. CRITFC also mentioned that the current shift caused by the Hells Canyon Complex results in an unnatural temperature regime. The Idaho Power Company submitted comments and a review in support of the SSC and its basis. Idaho DEQ acknowledged that the thermal shift is unnatural but rationalized (based on data and information provided in the submittal) that the SSC is protective of the designated use.¹²

One of the major comments is that the studies cited by the state are not comparable enough to the conditions that would be allowed by the SSC, and therefore are not a reasonable justification to support an approval of the SSC. There is no individual laboratory study that exactly recreates the effects of temperatures in the Snake River allowable under the SSC. NMFS in its Opinion relied on the individual studies independently and did not rely on the regression model submitted by the state to determine whether the revised SSC is protective.

The EPA highlighted our reservations with relying on the Hanford Reach data as a proxy for fall-run Chinook spawning and incubation conditions in the Snake River in the BE (EPA 2019); however, NMFS provided a counterargument in its Opinion, asserting that the Hanford Reach data provide weight of evidence in support of the analysis that the SSC is reasonably protective of fall-run Chinook spawning (NMFS 2019). In its Opinion, NMFS identified additional recent information, including the rebounding of the adult fall Chinook returns through 2015, and the successful spawning in the Hanford Reach under conditions as warm as the SSC for two weeks of the spawning period, to support of the protectiveness of the revised SSC.¹³ The EPA's determination that the revised SSC for temperature will protect Idaho's aquatic life designated use of Snake River fall-run Chinook spawning is informed by the analysis performed by NMFS.

Future conditions and relation to this SSC

Several commenters raised the issue of climate change and how it could affect fall Chinook spawners and spawning. NMFS (2019) concluded that the main effect of climate change would be to render the SSC less attainable (i.e., it would result in temperatures exceeding the SSC more frequently and/or at a larger delta), since NMFS identified that the revised SSC during the period when the WMT of 14.5°C magnitude applies (October 23; first calculated on October 29 through November 6) is currently not achieved in the Snake River (recent daily maximum temperatures 0.8-1.0°C higher than what the SSC requires during the early part of the designated spawning period (NMFS 2019, Table 7). Finally, commenters mentioned that climate change and other stressors could result in multiple cumulative impacts to Snake River fall-run Chinook, lending further uncertainty to the future of the species and

¹² Oregon temperature WQS for the Snake and Columbia Rivers include a narrative provision requiring that river temperatures reflect the "natural seasonal thermal pattern," however, Idaho's WQS do not include that provision.

¹³ Note that the Hanford Reach cold water refugia and thermal complexity were not precisely characterized; temperatures were measured near the major spawning grounds. In addition, NMFS (2019) identified many factors influencing the vulnerability (lack of certainty) of recovery in the population, including hatchery production dominance and genetic diversity concerns, as well as volatility in ocean conditions, as reasons for continuing population vulnerability.

rendering it essential to limit additional stressors such as increasing the allowable river temperature magnitude within the Snake River.

The BE identified that increasing allowable water temperature could reduce the plasticity of cold-water fish species thereby impacting their survival and fitness under rapidly changing climate conditions. NMFS is requiring monitoring as a conservation measure. EPA supports this measure as a means to provide more certainty and better protection now and in the future.